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violet, and that, not only for these rays as a whole, but for the rays of each refrangibility in particular. For this purpose it is sufficient to form a pure spectrum with sun-light as usual, employing instead of a screen a vessel containing a decoction of the bark of the horse-chestnut, or a slab of canary glass, or some other highly sensitive medium, and then to interpose the medium to be examined, which, if fluid, would have to be contained in a vessel with parallel sides of glass. Glass itself ceases to be transparent about the region corresponding to the end of the author's map, and to carry on these experiments with respect to invisible rays of still higher refrangibility would require the substitution of quartz for glass. The reflecting power of a surface with respect to the invisible rays may be examined in a similar manner.

The effect produced on sensitive media leads to interesting information respecting the nature of various flames. Thus, for example, it appears that the feeble flame of alcohol is extremely brilliant with regard to invisible rays of very high refrangibility. The flame of hydrogen appears to abound in invisible rays of still higher refrangibility.

By means of the phenomena relating to the change of refrangibility, the independent existence of one or more sensitive substances may frequently be observed in a mixture of various compounds. In this way the phenomenon seems likely to prove of value in the separation of organic compounds. The phenomena sometimes also afford curious evidence of chemical combinations; but this subject cannot here be further dwelt upon.

The appearance which the rays from an electric spark produce in a solution of sulphate of quinine, shows that the spark is very rich in invisible rays of excessively high refrangibility, such as would plainly put them far beyond the limits of the maps which have hitherto been made of the fixed lines in the chemical part of the solar spectrum. These rays are stopped by glass, but transmitted through quartz. These circumstances render it probable that the phosphorogenic rays of an electric spark are nothing more than rays of the same nature as those of light, but which are invisible, and not only so, but of excessively high refrangibility. If so, they ought to be stopped by a very small quantity of a substance known to absorb those rays with great energy. Accordingly the author found that while the rays from an electric spark, which excite the phosphorescence of Canton's phosphorus, pass freely through water and quartz, they are stopped on adding to the water an excessively small quantity of sulphate of quinine.

At the end of the paper the author explains what he conceives to be the cause of the change of refrangibility, and enters into some speculations to account for the law according to which the refrangibility of light is always lowered in the process of internal dispersion.

2. "Analytical Researches connected with Steiner's Extension of Malfatti's Problem." By Arthur Cayley, M.A., Fellow of Trinity College, Cambridge. Communicated by J. J. Sylvester, Esq., F.R.S. Received April 12, 1852.

The problem, in a triangle to describe three circles each of them touching the two others and also two sides of the triangle, has been termed after the Italian geometer, by whom it was proposed and solved, Malfatti's Problem. The problem to which the author refers as Steiner's extension of Malfatti's Problem, is as follows: "To determine three sections of a surface of the second order, each of them touching the two others, and also two of three given sections of the surface of the second order," a problem proposed in Steiner's memoir '*Einige Geometrische Betrachtungen*,' Crelle, t. i. The geometrical construction of the problem in question is readily deduced from that given in the memoir just mentioned for a somewhat less general problem, viz. that in which the surface of the second order is replaced by a sphere; it is for the sake of the analytical developments to which the problem gives rise that the author proposes to resume here the discussion of the problem. The following is an analysis of the present memoir:—

§ 1. Contains a lemma which appears to the author to constitute the foundation of the analytical theory of the sections of a surface of the second order.

§ 2. Contains a statement of the geometrical construction of Steiner's extension of Malfatti's problem.

§ 3. Is a verification, founded on a particular choice of co-ordinates, of the construction in question.

§ 4. In this section, referring the surface of the second order to absolutely general co-ordinates, and after an incidental solution of the problem to determine a section touching three given sections, the author obtains the equations for the solution of Steiner's extension of Malfatti's problem.

§ 5. Contains a separate discussion of a system of equations, including as a particular case the equations obtained in the preceding section.

§§ 6 & 7. Contain the application of the formulæ for the general system to the equations in § 4, and the development and completion of the solution.

§ 8. Is an extension of some preceding formulæ to quadratic functions of any number of variables.

3. "On the Tides, Bed and Coasts of the North Sea or German Ocean." By John Murray, Esq. Communicated by George Rennie, Esq., F.R.S. Received March 20, 1852.

The author commences his paper by remarking that great similarity of outline pervades the western shores of Ireland, Scotland and Norway, and then observes that the great Atlantic flood-tide wave, having traversed the shores of the former countries, strikes with great fury the Norwegian coast between the Lafoden Isles and Stadland, one portion proceeding to the north, while the other is deflected to the south, which last has scooped out along the coast, as far as the Sleeve at the mouth of the Baltic, a long channel from 100 to 200 fathoms in depth, almost close in shore, and varying from 50 to 100 miles in width. After describing his method of con-